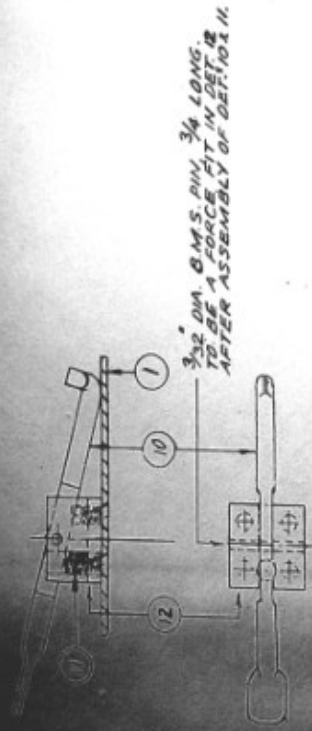
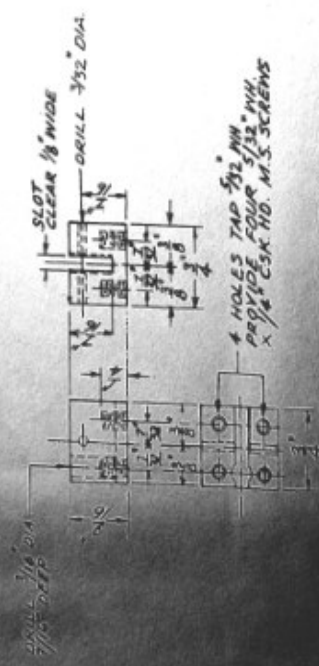
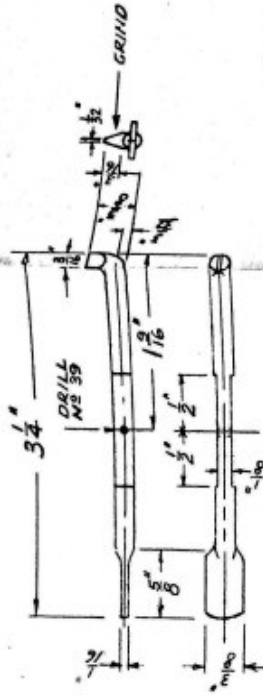




9 ASSEMBLY OF MOTOR SPINDLE LEVER

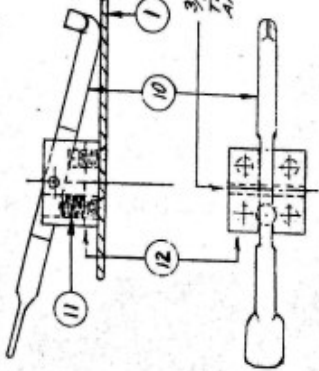




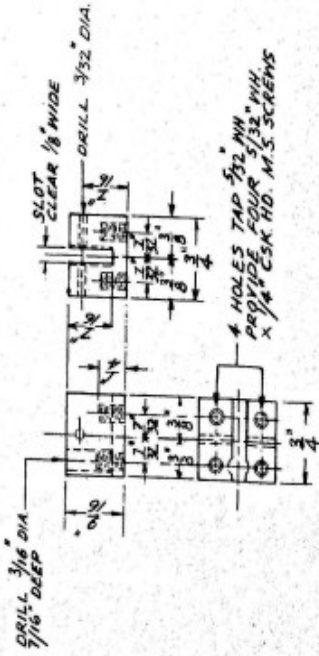


10 LEVER, 1/4 DIA. M.S.  
1 OFF FULL SIZE  
CADIUM PLATED.

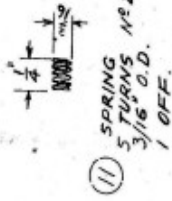
3/32 DIA. 8 M.S. PIN, 3/4 LONG.  
TO BE A FORCE FIT IN DET. 12  
AFTER ASSEMBLY OF DET. 10 & 11.



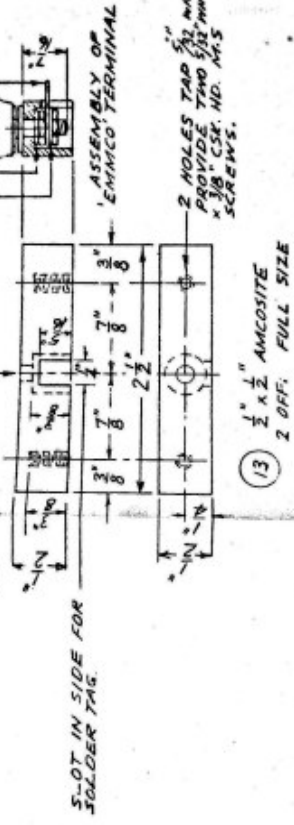
9 ASSEMBLY OF MOTOR SPINDLE LEVER



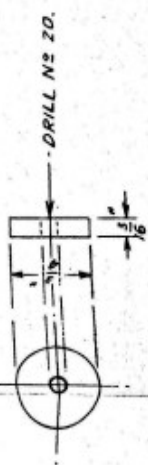
12 BRASS  
1 OFF F.O.D.  
FULL SIZE.



11 SPRING NO 22 G. PLANO WIRE  
5/16" O.D.  
1 OFF.



13 1 1/2 X 2 1/2 AMCOSITE  
2 OFF FULL SIZE



14 INSULATOR  
1 OFF BAKELITE  
SCALE - FULL SIZE

SECRET

REFERENCE

REFERENCE DRAWINGS  
CX 74 SHEET 1 GENERAL ASSEMBLY  
CX 74 " 2 CHASSIS STRUCTURE  
CX 74 " 3 PANELS & BRACKETS.

DL DRAWING

X

VGB

J.M.C

71XR

81XC

NO.

1

DATE

1-4-42

ISSUES

AMENDMENTS

COMMONWEALTH OF AUSTRALIA

P.M.G.S. DEPARTMENT

R.P. EQUIPMENT

SWITCHING MOTOR TESTER

MISCELLANEOUS DETAILS

SCALE: FULL SIZE.

DRAWN VGB

EXAMINED R.W.D.

APPROVED R.W.D.

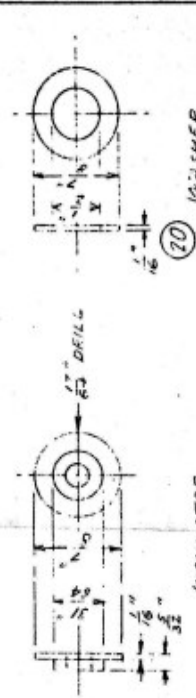
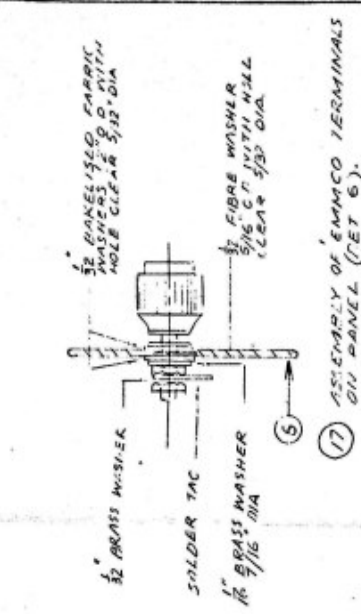
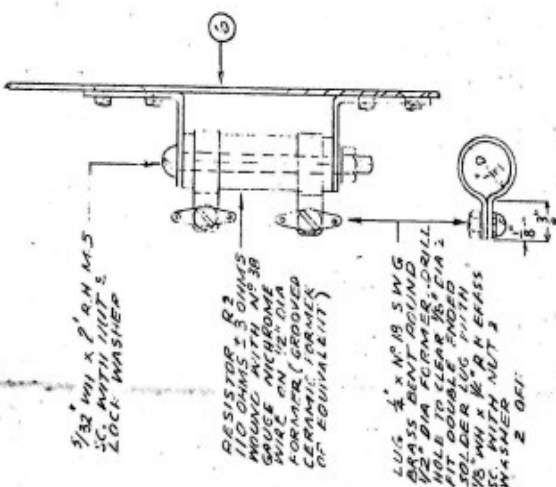
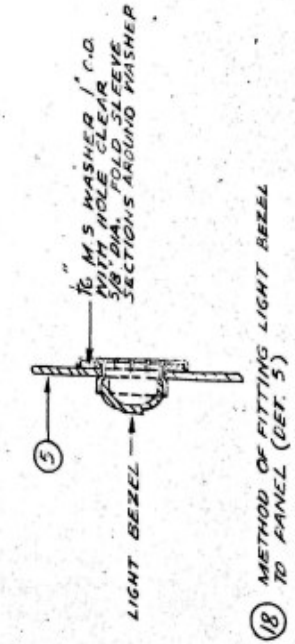
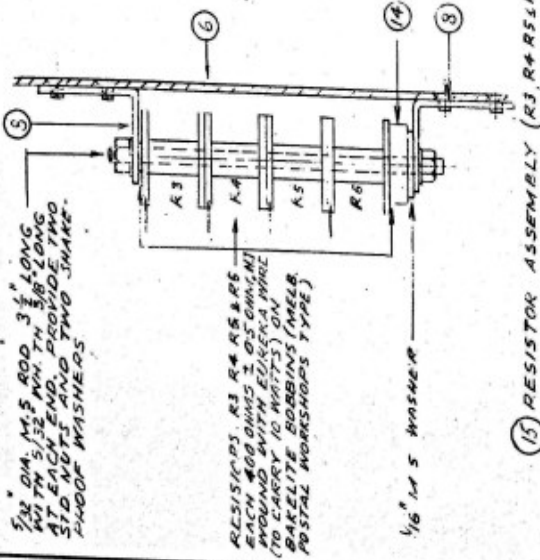
DATE 3-11-42

DRAWING NO.

CX 74

SHEET 4

SECRET



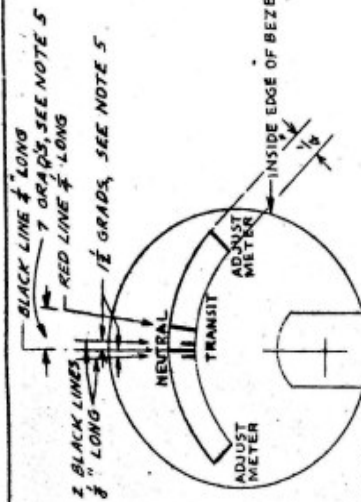
12 OFF PER TESTER  
SCALE - TWICE FULL SIZE

12 OFF PER TESTER  
SCALE - TWICE FULL SIZE

12 OFF PER TESTER  
SCALE - TWICE FULL SIZE

12 OFF PER TESTER  
SCALE - TWICE FULL SIZE

| REFERENCE   |  |  |  | ISSUES            |  |  |  | COMMONWEALTH OF AUSTRALIA |  |  |  |
|-------------|--|--|--|-------------------|--|--|--|---------------------------|--|--|--|
| DRAWING NO. |  |  |  | AMENDMENTS        |  |  |  | P.M.G.S. DEPARTMENT       |  |  |  |
| V.G.F.      |  |  |  | DATE              |  |  |  | R.P. EQUIPMENT            |  |  |  |
| X 71XR      |  |  |  | 1 13 11 43 P.W.B. |  |  |  | SWITCHING MOTOR TESTER    |  |  |  |
| J.M.L.      |  |  |  | 2 13 11 43 P.W.B. |  |  |  | DETAIL ASSEMBLIES         |  |  |  |
|             |  |  |  |                   |  |  |  | SCALE - FULL SIZE         |  |  |  |
|             |  |  |  |                   |  |  |  | DRAWING NO.               |  |  |  |
|             |  |  |  |                   |  |  |  | CX 74                     |  |  |  |
|             |  |  |  |                   |  |  |  | SHEET                     |  |  |  |

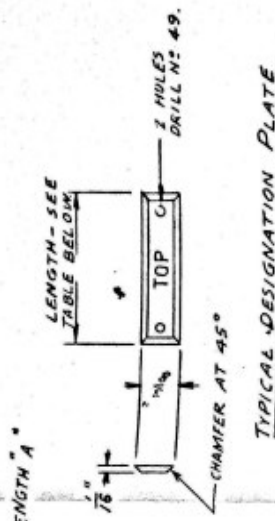


#### NOTES

1. RADIAL LENGTH OF SCALE IS TO BE AS THE EXISTING SCALE WHICH IS MARKED 50-0-50.
2. "ADJUST METER" IS TO BE MARKED AGAINST BLACK LINES 7/8" LONG AT EACH END OF SCALE.
3. IT IS IMPORTANT THAT "NEUTRAL" SHOULD ALSO BE IN BLACK CENTRALLY PLACED, AND THAT "TRANSIT" SHOULD BE IN RED IN ITS OFFSET POSITION AS SHOWN.
4. OTHER DIMENSIONS AND SIZES OF LETTERS TO BE AS ON METER MODEL K 35 AS MADE BY PATON ELECTRIC PTY. LTD.
5. DIMENSIONS "7 GRADS." AND "1/2 GRADS." REFER TO GRADUATIONS AS ON METER DIAL GRADUATED 50-0-50

#### DETAIL OF METER DIAL

1 OFF



TYPICAL DESIGNATION PLATE

PLATES ARE TO BE OF EBRONITE TO THE FOLLOWING LENGTHS:-

- A - 1-1/8"
- B - 1-3/8"
- C - 2-9/16"

AFTER DRILLING, PLATES ARE TO BE ENGRAVED AS SHOWN ON DETAIL 4 IN LETTERS 1/8" HIGH AND FILLED IN WHITE.

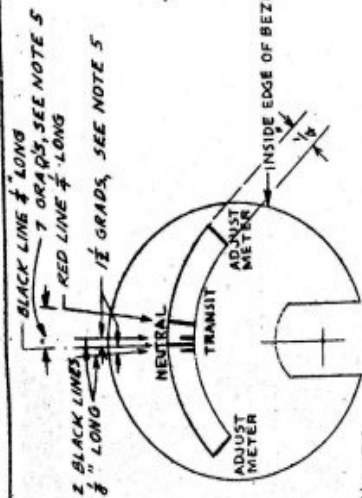
TAP PANEL TO B.A. OR 1/16" WHIT. AS REQUIRED FOR MOUNTING PLATES. SUPPLY 2 R.H. "S" SCREWS 1/8" LONG PER PLATE, EITHER TO B.A. OR 1/16" WHIT. TO SUIT. SCREWS ARE TO BE NICKEL PLATED.

SECRET

PANEL (DET. 4)

REFERENCE DRAWINGS :  
CX.74, SH.1 - GENERAL ASSEMBLY.  
CX.74, SH.3 - PANELS & BRACKETS

| COMMONWEALTH OF AUSTRALIA           |  |  |  | P.M.O.'S DEPARTMENT    |  |
|-------------------------------------|--|--|--|------------------------|--|
| R.P. EQUIPMENT                      |  |  |  | SWITCHING MOTOR TESTER |  |
| DESIGNATIONS                        |  |  |  | SCALE - FULL SIZE      |  |
| DRAWN V.S.B.                        |  |  |  | DRAWING NO. CX74       |  |
| EXAMINED R.W.B.                     |  |  |  | APPROVED R.W.B.        |  |
| DATE 3-11-42                        |  |  |  | SIGNATURE              |  |
| ORDER                               |  |  |  | ISSUES                 |  |
| D.L.                                |  |  |  | APPROVED               |  |
| NO.                                 |  |  |  | DATE                   |  |
| 71XR                                |  |  |  | 3-11-42                |  |
| 81XR                                |  |  |  | 3-4-43                 |  |
| DESIGN PLATES AND METER DIAL ADDED. |  |  |  |                        |  |

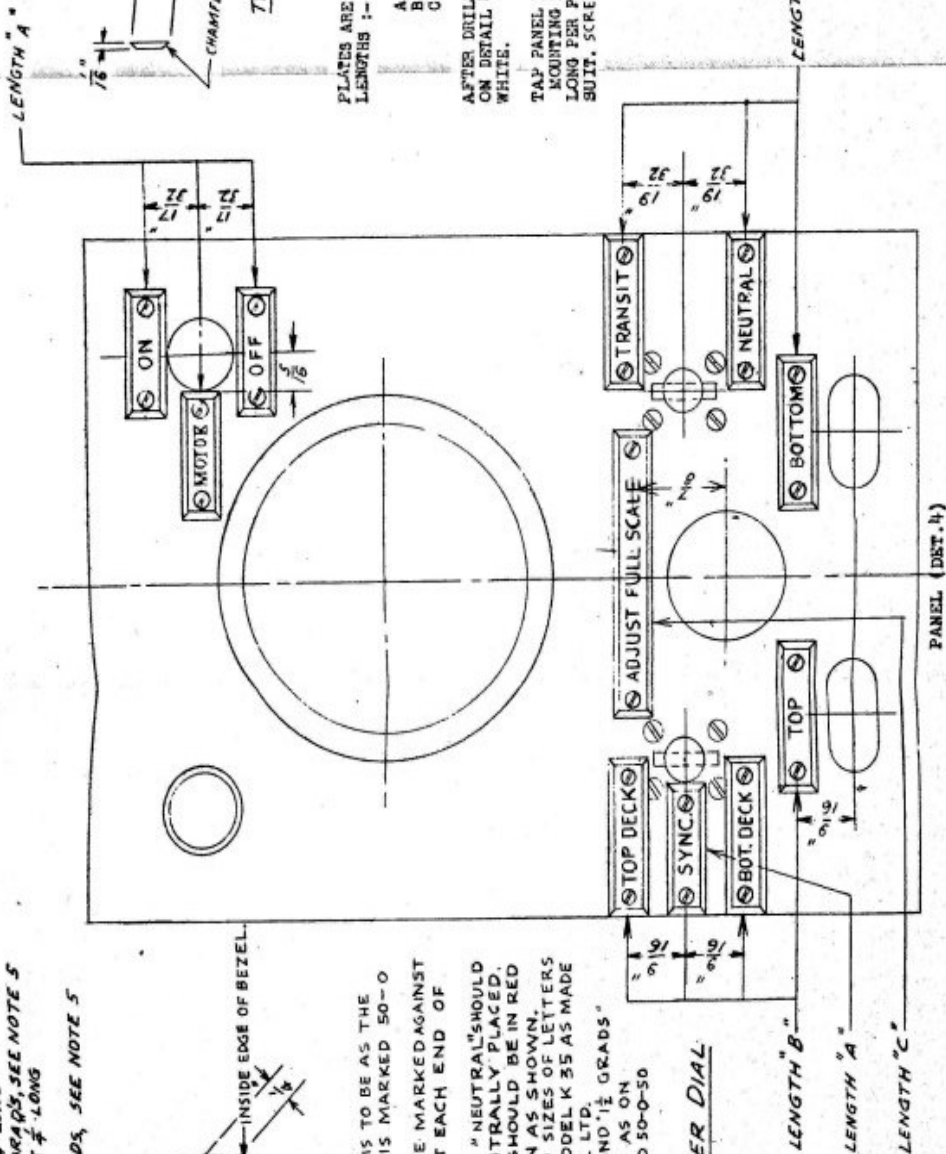


#### NOTES

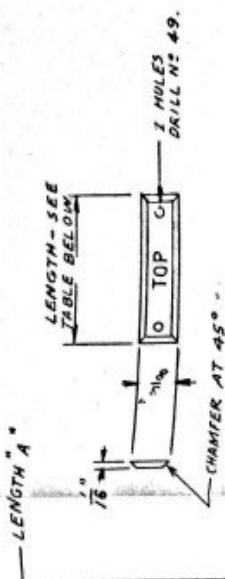
1. RADIAL LENGTH OF SCALE IS TO BE AS THE EXISTING SCALE WHICH IS MARKED 50-0-50.
2. "ADJUST METER" IS TO BE MARKED AGAINST BLACK LINES  $\frac{1}{4}$ " LONG AT EACH END OF SCALE.
3. IT IS IMPORTANT THAT "NEUTRAL" SHOULD ALSO BE IN BLACK CENTRALLY PLACED. AND THAT "TRANSIT" SHOULD BE IN RED IN ITS OFFSET POSITION AS SHOWN.
4. OTHER DIMENSIONS AND SIZES OF LETTERS TO BE AS ON METER MODEL K 35 AS MADE BY PATON ELECTRIC PTY. LTD.
5. DIMENSIONS "7 GRADS" AND "12 GRADS" REFER TO GRADUATIONS AS ON METER DIAL GRADUATED 50-0-50

#### DETAIL OF METER DIAL

1 OFF



PANEL (DET. 4)



#### TYPICAL DESIGNATION PLATE

PLATES ARE TO BE OF EBONITE TO THE FOLLOWING LENGTHS :-

- A - 1-1/8"
- B - 1-3/8"
- C - 2-9/16"

AFTER DRILLING, PLATES ARE TO BE ENGRAVED AS SHOWN ON DETAIL 4 IN LETTERS 1/2" HIGH AND FILLED IN WHITE.

TAP PANEL TO B.A. OR 1/16" WHIT. AS REQUIRED FOR MOUNTING PLATES. SUPPLY 2 R.H. & B. SCREWS 1/8" LONG PER PLATE, EITHER TO B.A. OR 1/16" WHIT. TO SUIT. SCREWS ARE TO BE NICKEL PLATED.

SECRET

REFERENCE DRAWINGS :  
CX.74, SH.1 - GENERAL ASSEMBLY.  
CX.74, SH.3 - PANELS & BRACKETS

| ORDER        | D.L. | NO. | DRAWN  | DATE    | APPROVED | AMENDMENTS |
|--------------|------|-----|--------|---------|----------|------------|
| 71XR<br>81XR | X    | 1   | VG.B.  | 3.11.42 | R.W.B.   |            |
|              |      | 2   | J.N.C. | 3.4.43  | R.W.B.   |            |

DESIGN PLATES AND  
METER DIAL ADDED.

COMMONWEALTH OF AUSTRALIA  
P.M.O.'S DEPARTMENT

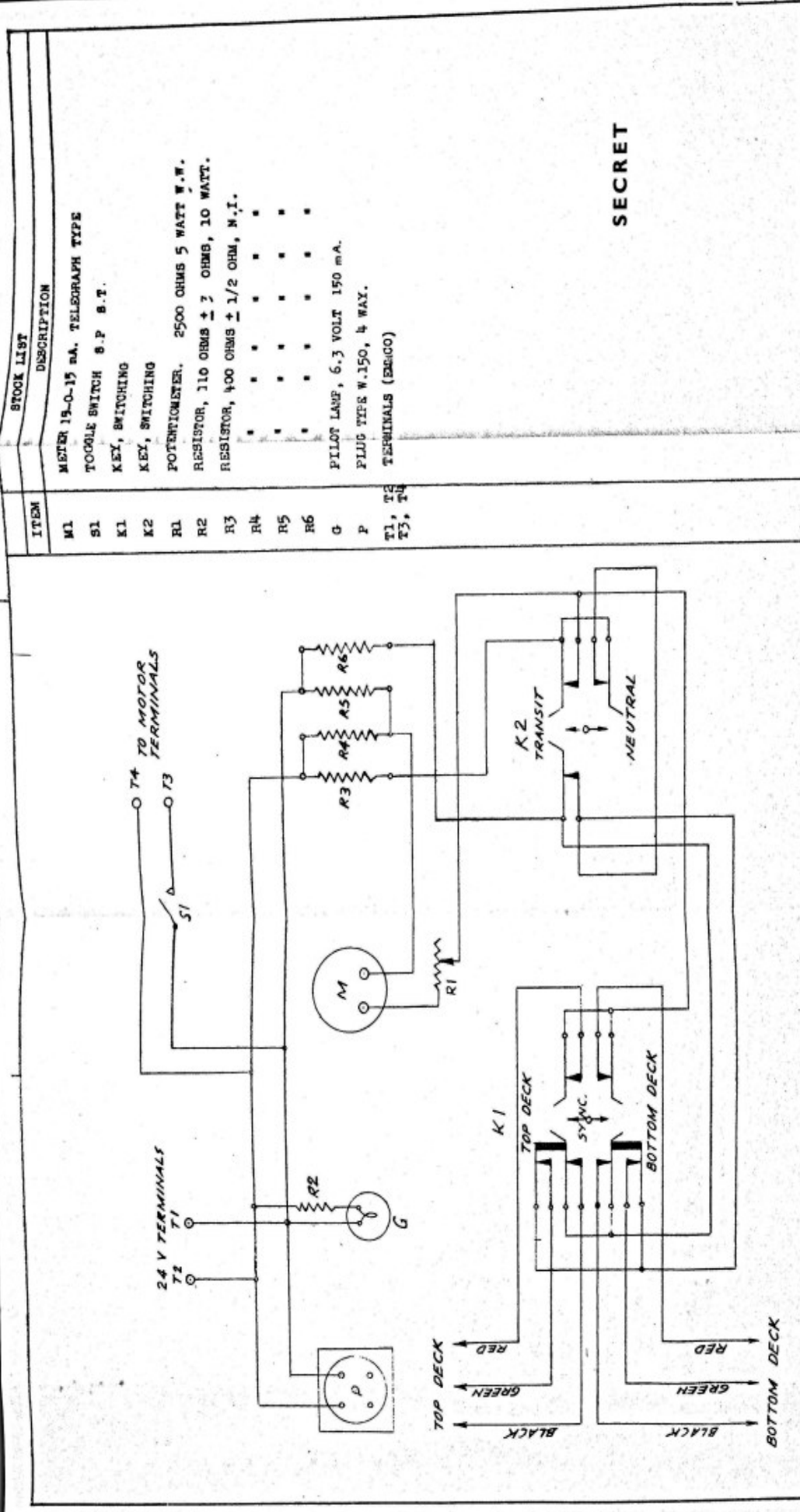
R.P. EQUIPMENT  
SWITCHING MOTOR TESTER  
DESIGNATIONS  
SCALE - FULL SIZE

DRAWN V.G.B.  
EXAMINED R.W.B.  
APPROVED A.W.A.  
ENGINEER  
DATE 3.11.42

DRAWING NO  
CX74  
SHEET 6

B

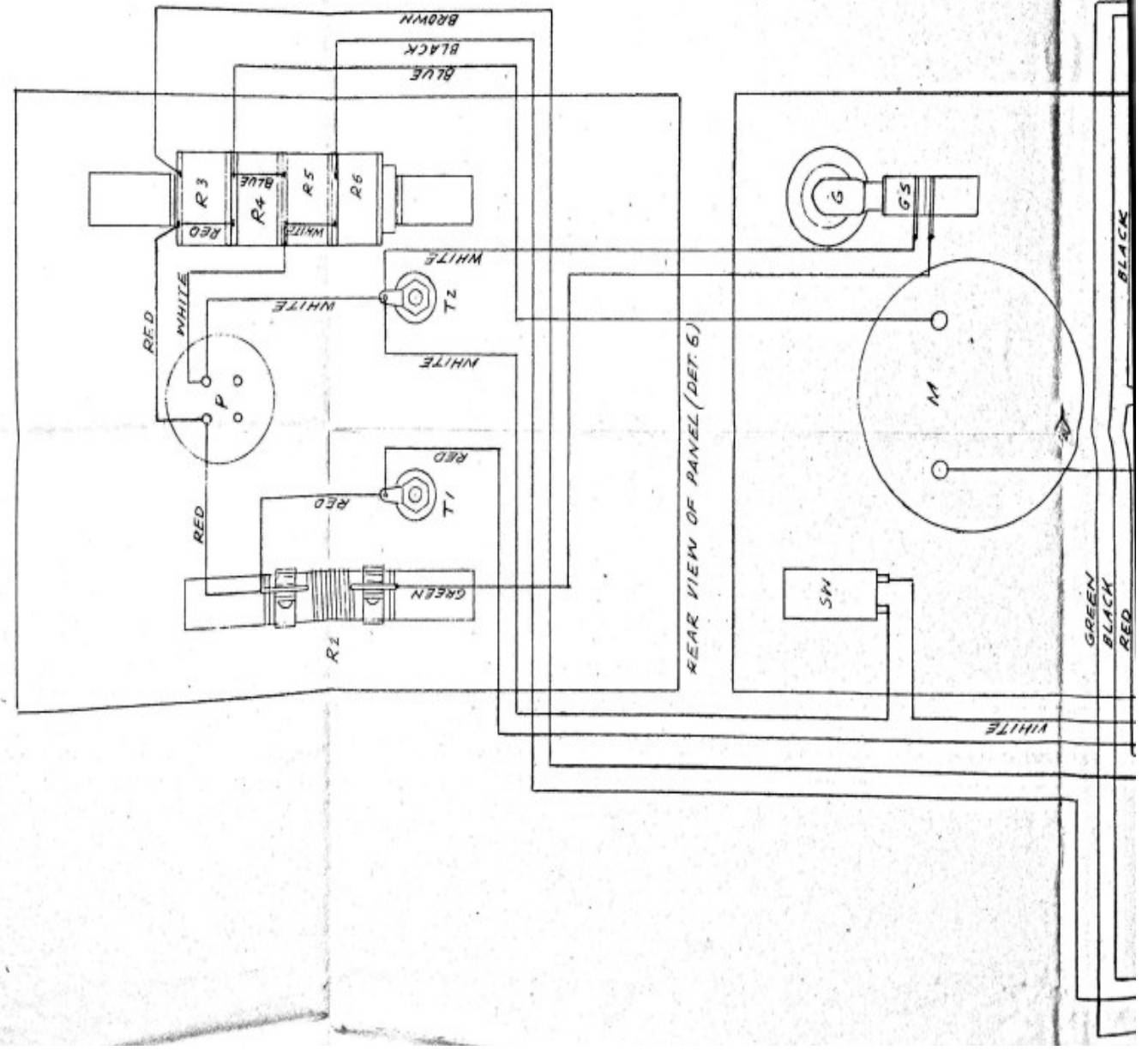




SECRET

| STOCK LIST     |                                           |
|----------------|-------------------------------------------|
| ITEM           | DESCRIPTION                               |
| M1             | METER 15-0-15 MA. TELEGRAPH TYPE          |
| S1             | TOGGLE SWITCH 8 P. S.T.                   |
| K1             | KEY, SWITCHING                            |
| K2             | KEY, SWITCHING                            |
| R1             | POTENTIOMETER. 2500 OHMS 5 WATT W.W.      |
| R2             | RESISTOR, 110 OHMS $\pm 2$ OHMS, 10 WATT. |
| R3             | RESISTOR, 400 OHMS $\pm 1/2$ OHM, M.I.    |
| R4             | "                                         |
| R5             | "                                         |
| R6             | "                                         |
| G              | PILOT LAMP, 6.3 VOLT 150 mA.              |
| P              | PLUG TYPE W.150, 4 WAY.                   |
| T1, T2, T3, T4 | TERMINALS (EMCO)                          |

|                                                                                                |                        |
|------------------------------------------------------------------------------------------------|------------------------|
| COMMONWEALTH OF AUSTRALIA<br>P.M.G. DEPARTMENT                                                 |                        |
| R.P. EQUIPMENT.<br>SWITCHING MOTOR TESTER<br>SCHEMATIC CIRCUIT.                                |                        |
| DRAWN: V.G.B.<br>EXAMINED: R.W.B.<br>APPROVED: R.W.B.<br>DATE: 3-11-42                         |                        |
| DRAWING NO.<br>CX 74<br>SHEET 7                                                                |                        |
| REFERENCE                                                                                      | Q.L. DRAWN             |
| REFERENCE DRAWINGS:<br>CX.74, SHEET 1 - GENERAL ASSEMBLY.<br>CX.74, SHEET 5 - DETAIL ASSEMBLY. | -X<br>V.G.B.<br>J.A.C. |
| DRAFTING ORDER NO.                                                                             | 71XR                   |
| ISSUES                                                                                         | AMENDMENTS             |
| NO.                                                                                            | DATE                   |
| 1                                                                                              | 3-11-42                |
| 2                                                                                              | 3-4-43                 |



[illegible]

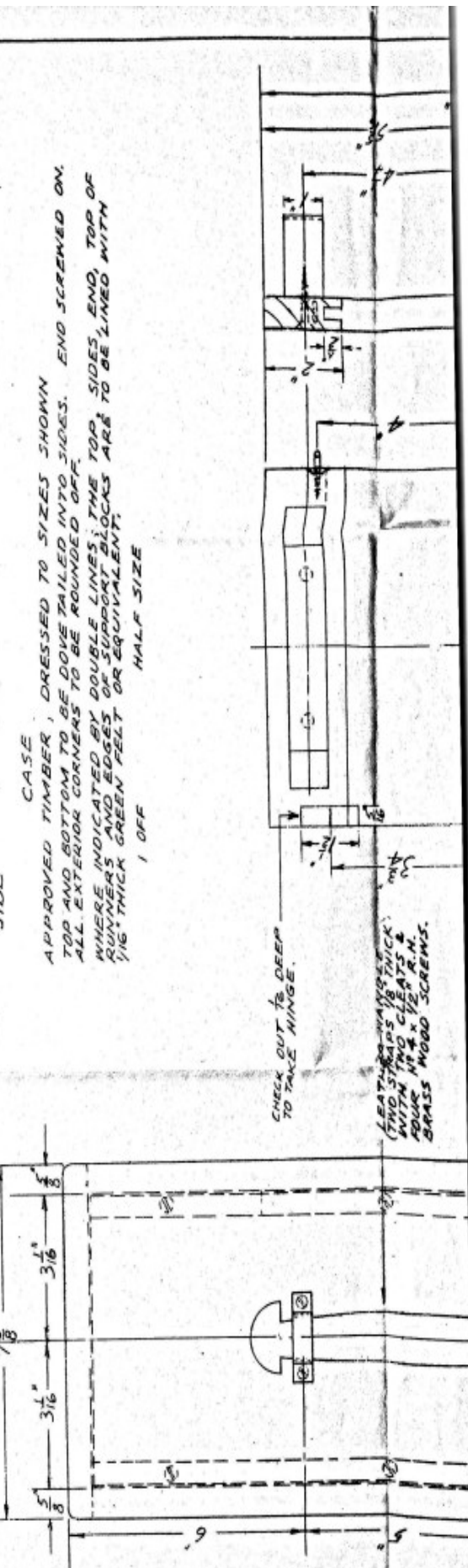
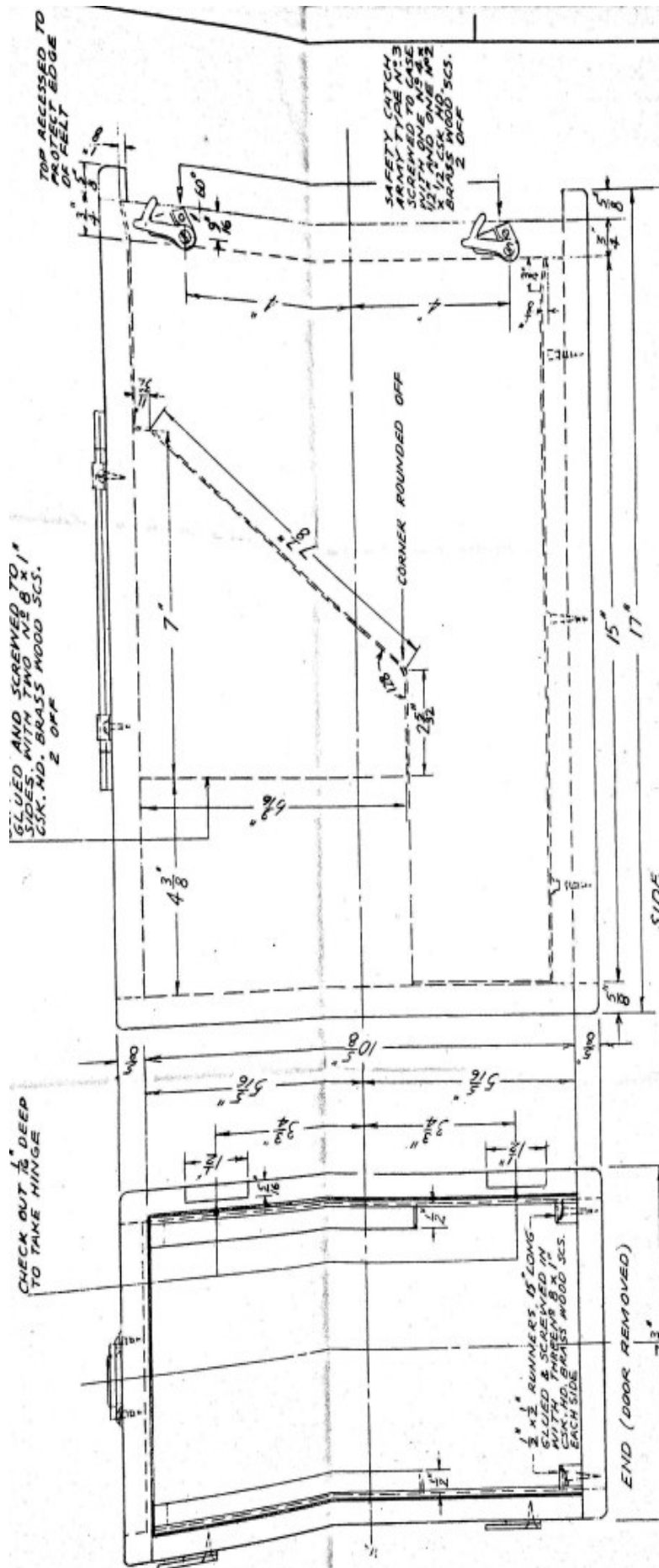
|          |                                  |
|----------|----------------------------------|
| 19/0.014 | TINNED COPPER WIRE OR EQUIVALENT |
| 19/0.011 | " " "                            |

INSIDE VIEW OF CHASSIS (DET. 1) & PANEL (DET. 4)

PART FRONT VIEW OF PANEL  
DETAIL 4

PYE CONN-  
FACTORS - SEE  
DETAIL ON  
SHEET 1.

[illegible]

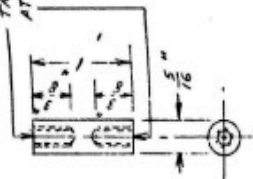






SECRET

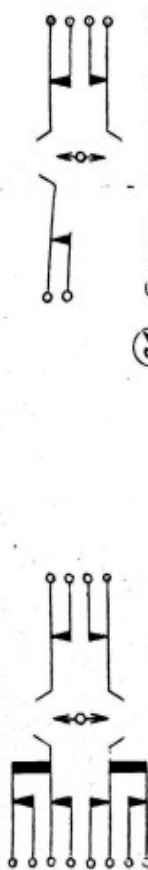
TAF  $\frac{1}{16}$ " WHIT  
AT BOTH ENDS



PILLAR

3 OFF BRASS SCALE-FULL SIZE  
FINISH - N.P AFTER MACHINING.

(25)



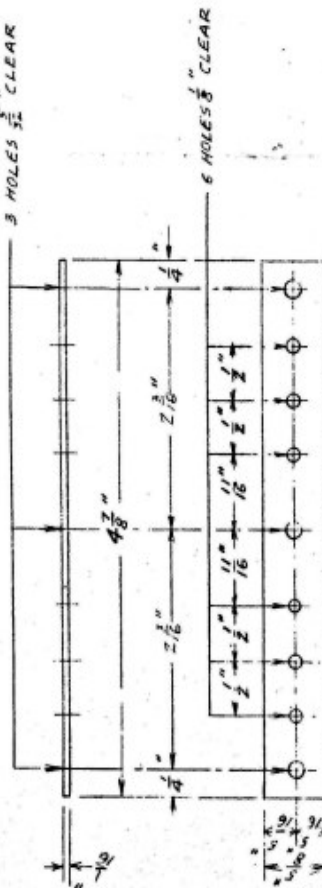
(24) SPRING SET FOR K2

1 OFF

SPRING SET FOR K1

1 OFF

3 HOLES  $\frac{1}{16}$ " CLEAR



6 HOLES  $\frac{1}{16}$ " CLEAR

MOUNTING STRIP

1 OFF BAKELISED CANVAS SCALE-FULL SIZE

(26)

REFERENCE  
CX 74, SH. 1. - GENERAL ASSEMBLY

DRAWN DL ORDER NO. DATE ISSUES  
J.N.L. X 81 XR 1 3-4-43 R.F.B.

COMMONWEALTH OF AUSTRALIA  
P.M.G.'S DEPARTMENT

R.P. EQUIPMENT.  
SWITCHING MOTOR TESTER  
DETAILS.

DRAWN J.N.L. 2-4-43  
EXAMINED APPROVED  
DATE ENGR. SHEET NO.  
CX 74

# A.M. TEST SET.

## TECHNICAL DESCRIPTION TESTING AND OPERATION.

### CONTENTS.

| <u>Section</u> |                                                             | <u>Page</u> |
|----------------|-------------------------------------------------------------|-------------|
| 1              | Introduction                                                | 1           |
| 2              | Description of Circuits                                     | 2           |
| 3              | Adjustments                                                 | 4           |
| 4              | Operation - for checking<br>units individually              | 6           |
| 5              | Use of test set for quickly<br>checking overall performance | 9           |

#### Drawings

Circuit Diagram, Dwg. No. C2083

Circuit Code for C2083

Figure 1 - Dwg. No. P2546

## A.V. TEST SET.

### TECHNICAL DESCRIPTION TESTING AND OPERATION.

#### INTRODUCTION.

It was desired to produce a unit with which to check the overall performance of the A.V. equipment. Further, the test unit in conjunction with an attenuator and monitoring dipole is capable of providing comparative measurements of the performance of each unit independently.

The units requiring checking, and the equipment required are:

| UNIT        | PROPERTY                                   | EQUIPMENT REQUIRED                                                                                   |
|-------------|--------------------------------------------|------------------------------------------------------------------------------------------------------|
| Transmitter | Power Output                               | Attenuator.<br>Peak voltmeter                                                                        |
| Array       | Transmitting Efficiency                    | Transmitter<br>Monitoring dipole<br>Peak voltmeter                                                   |
| T-R Switch  | Transmitting Efficiency                    | Transmitter -<br>monitoring dipole<br>Peak voltmeter                                                 |
|             | Suppression                                | Peak voltmeter                                                                                       |
|             | Receiving Efficiency and Deionisation Time | Transmitter-array-receiver.<br>Monitoring dipole and pulse generator.                                |
| Receiver    | Gain                                       | Output meter                                                                                         |
|             | Paralysis                                  | Transmitter-array-time base                                                                          |
|             | Sensitivity                                | C.W. signal generator                                                                                |
|             | Bandwidth                                  | Pulse generator                                                                                      |
| Time Base   | Calibration                                | Reliable fixed echoes, or independently, a unit producing artificial signals a known distance apart. |

Equipment already in existence:

Attenuator

Diode peak voltmeter

The test set embodies:

A signal generator operating on C.W. or pulse, whose output is preset and may be made any desired



amplitude between  $\frac{1}{10}$  and  $\frac{1}{\text{volt}}$ . The pulses are derived by modulating the grid and the modulator produces pulses spaced by time intervals corresponding to 10 miles range. The modulator is synchronised to the time base of the A.W. equipment by a square wave signal obtained from the timing circuit. A peak voltmeter of suitable ranges is also provided to give comparative voltage readings.

Thus the test unit in conjunction with the attenuator and dipole is capable of performing checks on the performance of each item listed above.

#### CIRCUIT

The circuit is shown in Dwg. C.2083.

#### 2.1 Signal Generator.

V9 is a 955 acorn triode arranged as a Hartley oscillator. The tuning system is a pair of lechers tuned by a split stator condenser C37 to cover a range of 180 - 210 Mc/sec. The plate of V9 is shunt fed through L13, a  $\frac{1}{2}$  wave 200 Mc/sec. choke and coupled by C43 a 50 pF condenser to the oscillatory system. The grid is coupled by C47, a 10 pF condenser, to the line which together with R65 provides the bias for the tube. A further connection is taken from the grid down the lecher tube and decoupled. This lead is brought to S-C-2 where it is either earthed or connected to the cathode of V7 through C49. The cathode is carefully decoupled and brought out to S-C-1, which is ganged with S-C-2. Then the grid is earthed, so also is the cathode, and the oscillator operates on C.7. In the mid position of S-C the cathode is biased with R46, a 20,000 ohm resistance bypassed with C35, 100 pF electrolytic condenser. Under these conditions no oscillations will occur. In the third position, the grid is connected to the output from the modulator section which is in the form of positive pulses. Thus the oscillator produces R-F pulses whose duration is determined by the modulator.

The plate feed is obtained from a potentiometer R19, the moving arm of which is by-passed. R19 provides an adjustment of the amplitude of the oscillations. The switch S-C-3 is arranged so that when the signal generator is operating on C.7, slightly higher voltage is applied to the plate. This has been done so that only a small adjustment of R19 is necessary, when switching from C.7. to pulse, in order to obtain the same amplitude of oscillations.

The plate of V8, an E.50 acorn diode, is tuned on to the lechers, its cathode is decoupled and the load R49, 5 megohms, by-passed with C34, a .1 pF condenser. The peak voltage of the R-F oscillations is indicated by V12 and the meter M as shown below.

The output from the oscillator is taken from a piston attenuator.

The mechanical construction of, and the filtering of, leads from this section is very important. The lower limit of the signal from the attenuator is determined by the leakage. On the development model the lower limit to the signal in a 75 ohm cable is of the order of  $\frac{1}{2}$  volt.

## 2.2 Modulator Section.

V3T2 is an oscillator of the tuned anode type.

V4 is an amplifying stage whose purpose is to produce an approximately square wave output. The output from V4 is taken through low time constant circuit C17 R28, which differentiates the square wave and produces a series of positive and negative pips. These are applied to the grid of V5 through R29. V5 is biased by R30, which has a bleed current from H.T. through R31 flowing through it. Thus the tube V5 only conducts during portion of each positive pip from V4. The output at the plate of V5 is a series of negative pulses. V6 further amplifies slopes and reverses the polarity of the pulses. V7 is a cathode follower which provides a low impedance output; from the cathode of V7 positive pulses are obtained.

The pulses are required to modulate the grid of the signal generator oscillator. It is required that the slope of the front of the pulse should be fast enough to ensure that the build up of the R-F pulse from the signal generator is governed by the characteristics of the 955 acorn oscillator tube. Theory indicates that this tube will build up from 10-6-100 volts in about  $\frac{1}{5}$   $\mu$ sec. This figure, however, seems optimistic. The slope of the modulator pulse front must be such that the time for the grid voltage to rise from cut off bias to that where oscillations can occur is short, c.f.  $\frac{1}{5}$   $\mu$ sec. This indicates

slopes of the order of 50 volts per  $\mu$ sec. A slope of about 100 volt per  $\mu$ sec. has been obtained on the development model.

It is desired that the pulses should be synchronised with the time base so that the pulses always occur in the same position on the C.R.O. screen. This is done by means of V1 and V2. To the grid of V1 is applied a synchronising signal in the form of square wave, the positive slope of which occurs at the same time as the time base commences its sweep. The output from V1 is a square wave which is applied to the grid of V2 and renders this valve non-conducting during the time base sweep, and conducting during the other half period of the synchronising square wave.

The valve V2 serves two purposes:

- (1) When conducting it acts as a low impedance across the tuned anode circuit of V3. It thus prevents oscillations occurring under these conditions.
- (2) When conducting it draws its anode current through the tuned winding of T2.

When V2 is out off, the shunting impedance is suddenly removed, and the tuned circuit is shock excited. The degree of excitation is determined by the anode current of V2 when conducting. Oscillations are maintained by V3. The peak oscillatory energy in the oscillatory system in the steady state is determined by the value of R16 R17 which provides bias and negative feedback. The initial oscillatory

energy in the shock excited train is determined by the value of the current drawn by V2 when conducting, i.e. by R15. R15 may be so chosen that after the first half cycle the amplitude of oscillation remains constant.

If it were not for the shock excitation, the oscillatory circuit would take many cycles to build up to a steady amplitude, during which time the calibration would be very unreliable.

In order that the interval between pulses should correspond to a range of 10 miles the frequency of the oscillator V3T2 must be adjusted to 9.315 Kc/sec. As no check on the frequency is provided, it is necessary that the stability of this oscillator should be reliable to 1 part in 1000. The transformer T2 is wound on a magnetite core and the tuning C9 of the order of 2000  $\mu$ af should be sufficiently large to swamp effects due to the valve.

### 2.3 Diode Voltmeter.

V10 is an EA50 acorn diode, mounted in a shielded box behind the front panel. The plate load is very short and connected to the back of a concentric connector on the front panel. R45 is a 75 ohm non-inductive resistor which terminates the cable connected to the connector. The cathode is by-passed with 100  $\mu$ af for R-F, and with a .1  $\mu$ f condenser L16 is a decoupling choke. The load is R48 R47 R60. R48 is a 750,000 ohm resistor so that the voltage across the load should be almost the peak voltage of R-F pulses applied to the plate of V10.

When S-B-3 is in the right hand position a portion of the voltage across the load of V10 is applied to the grid of V12.

V12 is a 6J7G connected as a triode, the plate tied to a point on the H.T. bleed about 60 volts positive. The load, R51 20,000 ohms, is in the cathode circuit, and R50 is inserted for the purpose of metering the tube current. R52 is a resistor inserted between H.T. and cathode to reduce the standing current, and also to produce a degree of independence of meter reading on the H.T. voltage variations. The value of R52 is such that  $R52 = \mu R51$ , where  $\mu$  is the amplification factor of the tube.

The meter has a full scale reading of 1 ma., and full scale deflection corresponds to about 22 volts. The standing current is about  $\frac{1}{10}$  ma.

When S-B 1-2-3- is in the right hand position the whole unit operates as a peak voltmeter only. H.T. supply to all the other tubes is removed.

### ADJUSTMENTS.

#### 3.1 Laboratory Adjustments.

- (a) Frequency of calibration oscillator must be adjusted by means of the condenser C9 to be 9.32 Kc/sec.  $\pm$  0.01 Kc/sec.

The switch S-A 1-2 in position TEST earths the grid of V1 and puts a large bias on the cathode

of V2. Under these circumstances the oscillator V3T2 oscillates continuously, and the frequency may be checked against a known frequency.

(b) A calibrator dial will be made for the oscillator tuning knob. The calibration will be fixed and the frequency of the oscillator at the mark on the dial corresponding to 200 Mc/sec. will be adjusted to be 200 Mc/sec. by moving a 5  $\mu$ f condenser along the lecher system. The calibration may then be checked at 180 Mc/sec. and 210 Mc/sec.

A convenient means of performing this frequency adjustment and checking the calibration is to use a receiver tuned by a calibrated signal generator to 200 Mc/sec. Then adjust the position of the fixed condenser on the lechers so that the test units signal generator produces 200 Mc/sec. with the dial in the required position.

### 3.2 Field Adjustments.

The attenuator setting is to be such that the signal into the receiver is such as will produce an output equal to that produced by noise. The signal is injected into a dipole and the array connected direct to the receiver.

#### Process

Switches on test unit should be: Meter switch - V.T.V.; "V.T.V." switch - VOLTS IN; "Sig. Gen." switch - C.W.; "Synch." switch - ON.

Switch meter switch on the receiver to position DET. Adjust gain of receiver till noise alone reads .1 ma. above the standing current.

Now switch "V.T.V." switch on test unit to SIG. GEN. and adjust "Carrier Set" potentiometer to make meter read .5.

Tune the signal generator frequency to give maximum receiver output.

Adjust attenuator setting so that with same receiver gain as before the output as measured by the receiver monitoring meter is .2 ma. above standing current.

If this adjustment is made at installation with a good receiver, the performance thereafter may be checked as in section 4.5 below.

In the above it has been assumed that a dipole is available whose position is fixed in relation to the array. If this is not practicable then the only other way to obtain information on each of the units in the equipment separately is to use a dipole fixed in position, e.g. on the roof of the R.D.F. hut. If this second procedure is adopted, then the array must always be turned to a point in a fixed direction at or nearly at the centre of the dipole when the tests are to be performed.

The limitation on the suitable position of the dipole is that to get a voltage induced in the dipole



at about 50 volts for 10 KW the transmitter power, it will be necessary to have the dipole well up in the beam of the array.

#### 4. OPERATION.

The unit will be used in conjunction with two other units, namely the power attenuator, and a monitoring dipole. The dipole may be attached to the array, otherwise it may be fixed in some convenient position and the array turned to a specified position to do the tests. In order to do complete tests on the equipment an oscilloscope also is required to give the transmitter pulse length. However, if the receiver and time base can be proved to be satisfactory a sufficiently good check of the transmitter pulse length is obtained by observation of the length of strong echoes from small objects.

##### 4.1 Transmitter Power Output.

Connect the output from the transmitter to the power attenuator, and the output from the power attenuator to the connector labelled VOLTS IN on the front panel of the test unit.

Switch the switch marked "V.T.V." to VOLTS IN, and the meter switch to position V.T.V.

With the transmitter off the meter will read the standing current of the tube V12. This should amount to about  $\frac{1}{10}$  mA.

The range of the voltmeter with S1 open is approximately 400 volts. Assuming the power output from the transmitter is 10 KW, then the voltage across the 75 ohm terminating resistor should be about 180 volts. Thus the reading on the meter should be about .5.

As there has been no specification of the power output, it is not possible to indicate the voltmeter reading, but it should be not less than .5. The procedure will be to make a note of the reading obtained and check it periodically to see that it does not change suddenly.

##### 4.2 Array Transmitting Efficiency.

Connect the array directly to the transmitter.

Connect the cable from the monitoring dipole on the array to the connector marked VOLTS IN on the test unit. When the transmitter is operating a voltage will be induced in the dipole which will give, indirectly, a measure of the power radiated from the array. The dipole should be affixed to the reflector and in a position similar to that used for the Sh.D stations. In this position it is not feasible to deduce the radiated power directly from a knowledge of the voltage induced in the dipole. It is, however, possible by using a test dipole placed out on the axis of the beam to calculate the radiated power. This will be done on installation, and the reading on the test unit noted. Thereafter this reading should be checked frequently.

The voltage induced in the dipole for 10 KW output from the transmitter is expected to be about 50 volts. The range of the V.T.V. with the push switch S1 depressed is 100 volts, providing a suitable scale on which to check the readings.



#### 4.3. Loss through T-R Switch when Transmitting.

Connect the T-R switch into the circuit.

Again measure the voltage induced into the dipole when the transmitter is switched on.

The power efficiency of the T-R switch when transmitting is the square of the ratio of voltages measured here and in the previous section. The power loss should not exceed 10%.

#### 4.4 Suppression of Ground Pulse Reaching Receiver.

Connect the receiver output of the T-R switch to the connector marked VOLTS IN on the test unit. The voltage reaching the receiver should not exceed 27 volts. The 100 volt range of the V.T.V. provides a convenient means of checking this.

#### 4.5 Receiver.

The required tests on the receiver are:

- (a) Gain
- (b) Paralysis
- (c) Sensitivity
- (d) Bandwidth

- (a) Gain may be checked simply by the noise output from the receiver, assuming that the signal/noise ratio is correct.

This assumption is checked under section (c)

- (b) Paralysis may be checked by observing the noise amplitude. General paralysis is observable by noting the noise amplitude at a part of the screen free from strong echoes. The amplitude should remain constant to, say, 10%, whether the transmitter is switched on or off. Local paralysis is observed by noting the amplitude of noise immediately after the fixed echoes following the ground pulse. If no paralysis occurs the noise amplitude should reach constant height immediately the strong signals cease. An interval for recovering after very strong signals such as the ground pulse, of 5 miles, should be considered the maximum tolerable.

#### Note

The above tests (a) and (b) may be performed without any external test equipment. In conjunction with tests (c) and (d) the complete performance of the receiver may be checked.

- (c) Sensitivity. The monitoring meter on the receiver may be used to read the detector current. This, in conjunction with a C.W. signal generator, provides the most accurate means of checking the signal/noise ratio of the receiver.

With no signal into the receiver the gain

is set so that the noise output increases the diode current by some small amount, say .1 ma. above the standing current. Then with A.C.F. signal injected at the aerial the diode current will increase further. The signal which is required to double the detector current is known for a receiver of a given type, so with the signal input arranged to be this value, if the receiver under heat is satisfactory, the signal input should double the noise current.

It is convenient to have a single preset output from the test unit. Also for other reasons, (see test of T-R switch deionisation time), it is desirable to obtain a signal to the receiver by connecting the signal generator to the dipole and picking up the signal on the array. The method of injecting a signal into the receiver is to connect the output from the signal generator to the dipole, and the array directly to the receiver. The attenuation introduced between the output of the signal generator and the input of the receiver will remain constant, provided the test as in section 4.2 has indicated that the array efficiency is normal.

As in section 3.2 the attenuator of the signal generator has been set. Hence to check the receiver sensitivity:

Switch receiver meter switch to DET.  
Switch test units meter switch to V.T.V., "V.T.V." switch to VOLTS IN, "Sig. Gen." switch to C.W.  
Connect the dipole to the "Sig. Gen. Output" of the test unit and the array direct to the receiver input.  
Adjust gain of receiver till the receiver meter reads .1 above standing value.  
Switch "V.T.V." switch on test unit to "Sig. Gen." and adjust "Carrier Set" potentiometer to make the test unit's meter read .5.

The receiver meter should read .2 above standing current when the frequency of the test unit generator has been adjusted to give maximum receiver output.

(d) Band width. Reduce the receiver gain and connect the output from the signal generator direct to the receiver. The shape of the pulses, which is best observed on the expanded scale of the time base, indicates the overall band width of the receiver and video circuit. It is not feasible to make accurate measurements on the pulse shape. In general, however, the pulse shape observed will approximate to that shown in Fig. 1a. This is a result of distortion in the circuits preceding the detector, which produce a fairly symmetrical pulse shape as in Fig. 1b, and also in the video circuits where the distortion is rather in the form of two experimental curves as in Fig. 1c. The ratio of the lengths between 10% and 80% of maximum height should be about 3:2 for a satisfactory shape.

#### 4.6 T-R Switch Deionisation Time and Maximum Efficiency.

The maximum receiving efficiency of the T-R switch may be checked by measuring the increase in the receiver detector current above noise when the signal generator is connected to the monitoring dipole and the array connected, first directly to the receiver, and then through the T-R switch to the receiver. The reduction of the increase

in current in the second case should be only of the order of 3%, i.e. there should be practically no observable change if the T-R switch is operating satisfactorily.

To check the deionisation time of the gaps in the T-R switch, connect the test unit as above, and switch the "Sig. Gen." switch to PULSE. Observe that the pulses on the screen on contracted scale are of uniform amplitude and of about twice the noise amplitude. Switch on the transmitter. The tops of the pulses will be points on the deionisation curve, provided the array is turned to a point where there are no fixed echoes, and the receiver does not paralyse. With new gaps the deionisation time should be too short to produce an observable reduction of amplitude of the first pulse which occurs 10 miles after the ground pulse. As the gap deteriorates the deionisation time becomes larger. Provided the amplitude of the pulses has reached a maximum within 20 miles from the ground pulse, the gap could be considered satisfactory in this respect.

#### 4.7 Time Base Calibration

The R-F pulses produced by the signal generator are spaced so that their distance apart is equivalent to 10 miles range. The output from the receiver when the signal generator is connected directly to the receiver is in the form of clean pulses, devoid of noise. The time base may be calibrated from these pulses.

Adjust the balance of the amplifier, then set the range potentiometer on the mark 10. Adjust the "Adj. Zero Exp." control to bring the beginning of the first pulse under the cross wire. Then check the calibration at each succeeding 10 mile interval.

#### 5. USE OF TEST SET FOR QUICKLY CHECKING OVERALL PERFORMANCE.

In section 3 has been set out the tests on each unit of the equipment. To perform the test set out in the detail given there would be required more for localising a fault than for obtaining a running check on the performance of the station.

The method of using the test set as an overall check on performance should be to have it in the hut with a lead from the monitoring dipole available.

Test 1 Attach dipole to "Volts In" connector on test unit. Switch "V.T.V." switch to VOLTS IN and observe the meter reading. The reading will be a measure of the power radiated. An observation of this reading at installation of the station indicates what it should be for normal transmitter power, T-R switch efficiency, and array gain.

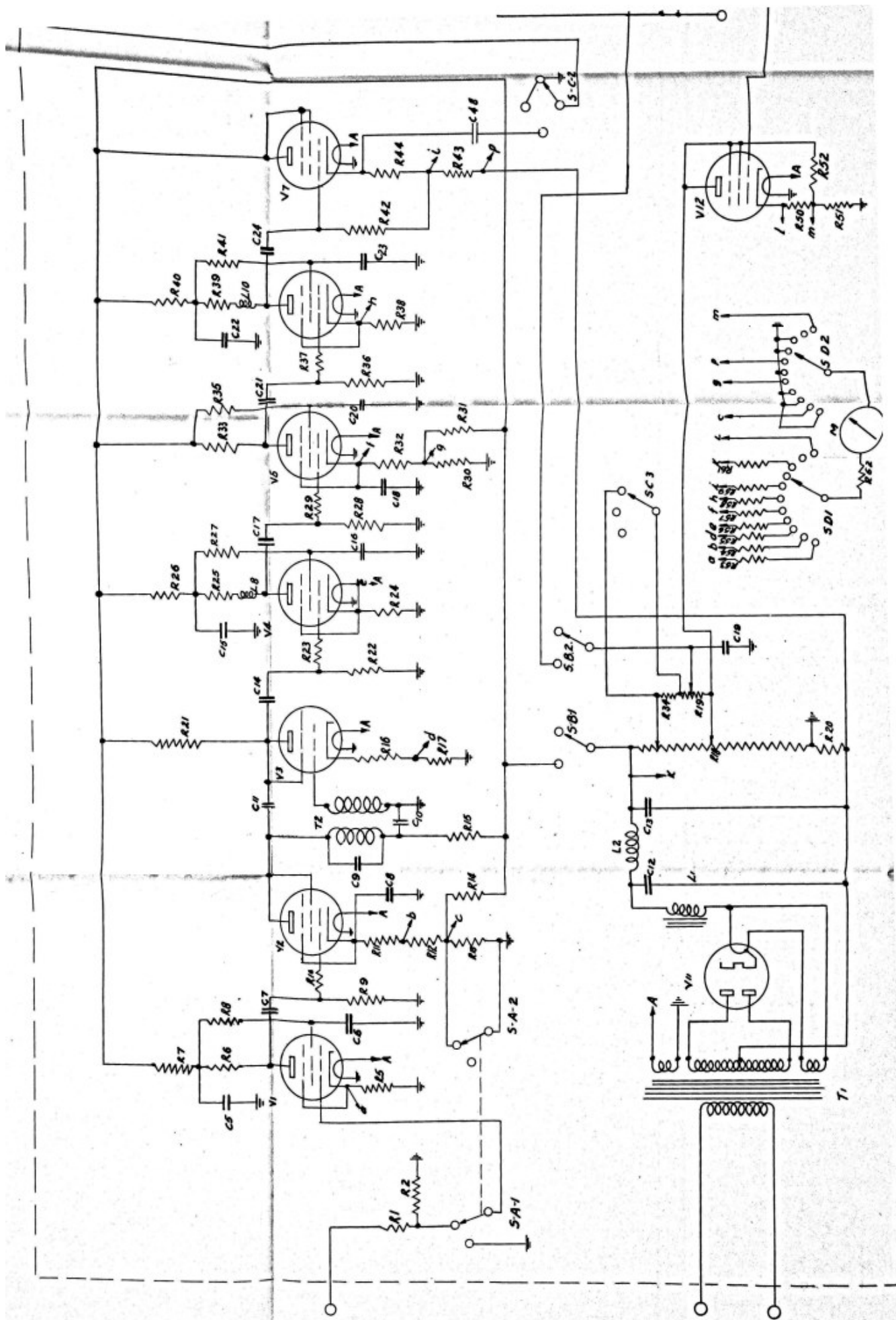
Test 2 Attach dipole to "Sig. Gen. Output" Switch off transmitter. Adjust receiver gain till the meter, when reading detector current, reads .1.

Switch "V.T.V." switch to SIG. GEN. and adjust "Carrier Set" potentiometer until the meter on the test unit reads .5. The receiver meter should read .2 when the generator frequency is tuned to give maximum output.

N.H. The setting of the attenuator to produce this result with a satisfactory receiver will be done at installation.

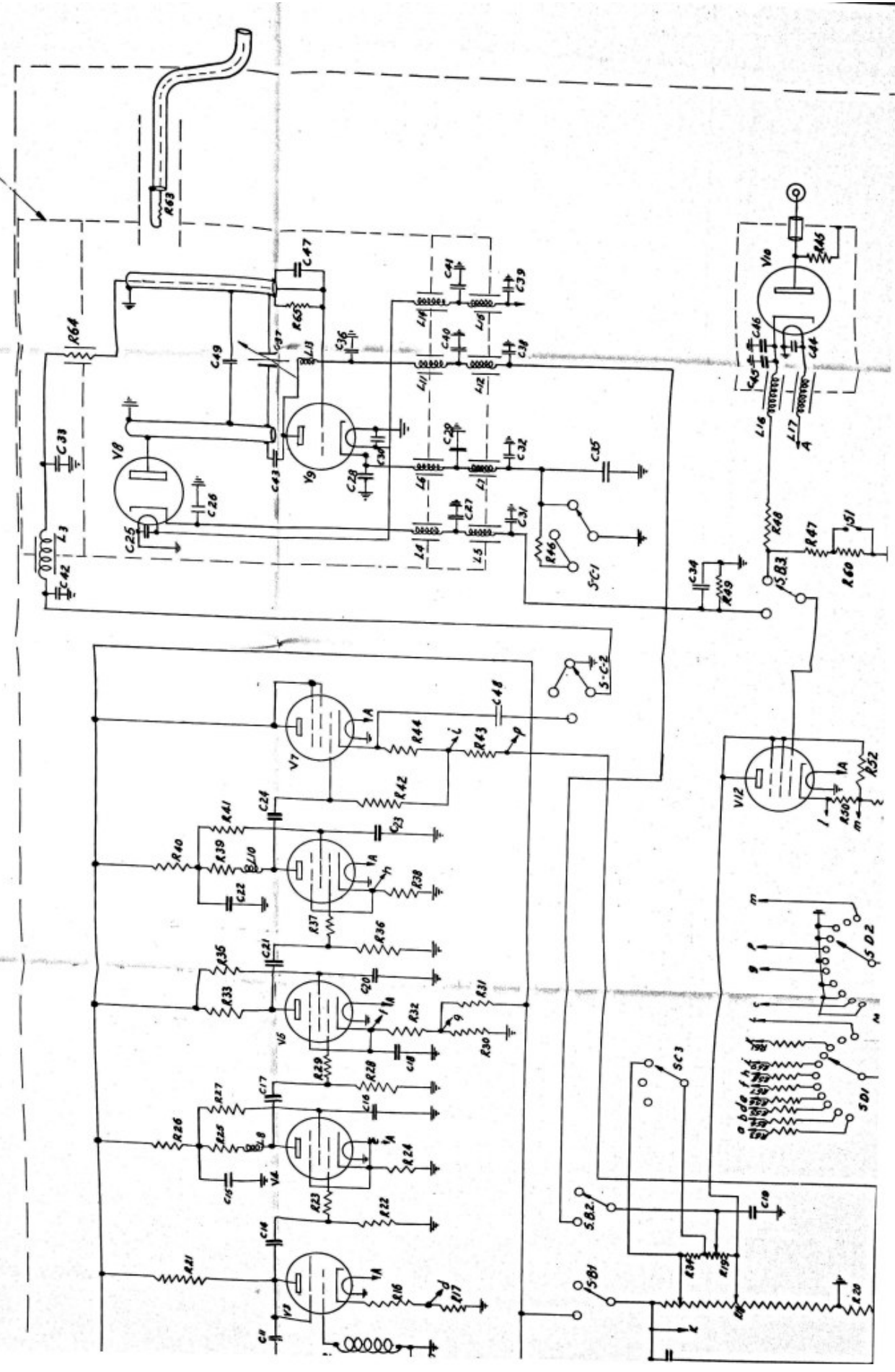
(The calibration of the signal generator's frequency control will provide a check on the frequency at which the station is operating provided the receiver is tuned to the transmitter frequency).

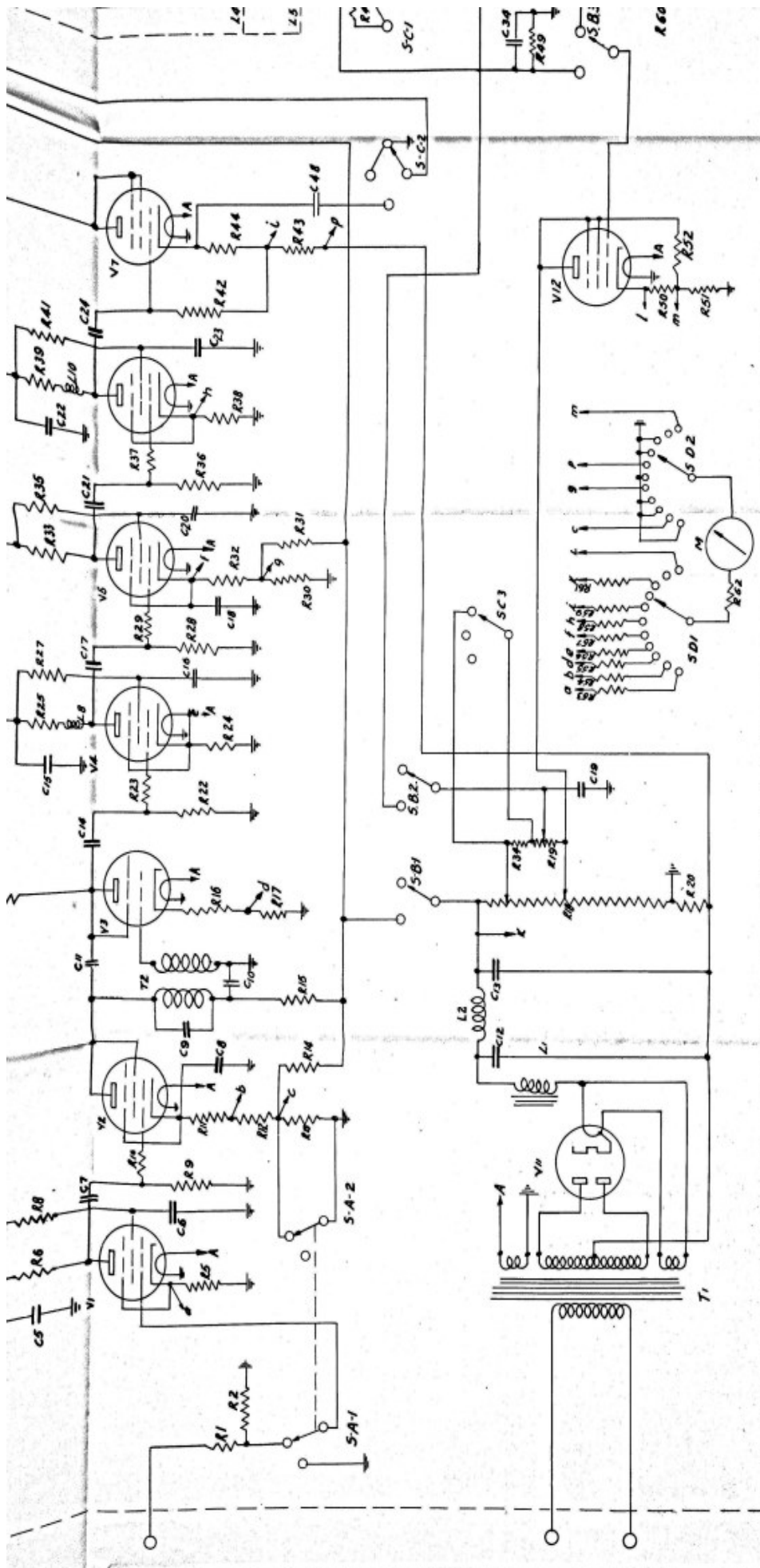
Test 3. Switch "Sig. Gen." switch to pulse. Increase gain of the receiver and observe the pattern on the screen. This should consist of a series of pulses whose amplitude is double that of the average noise amplitude. Switch on transmitter. With the array pointing to a point where there are very few fixed echoes, the pattern should remain as above.





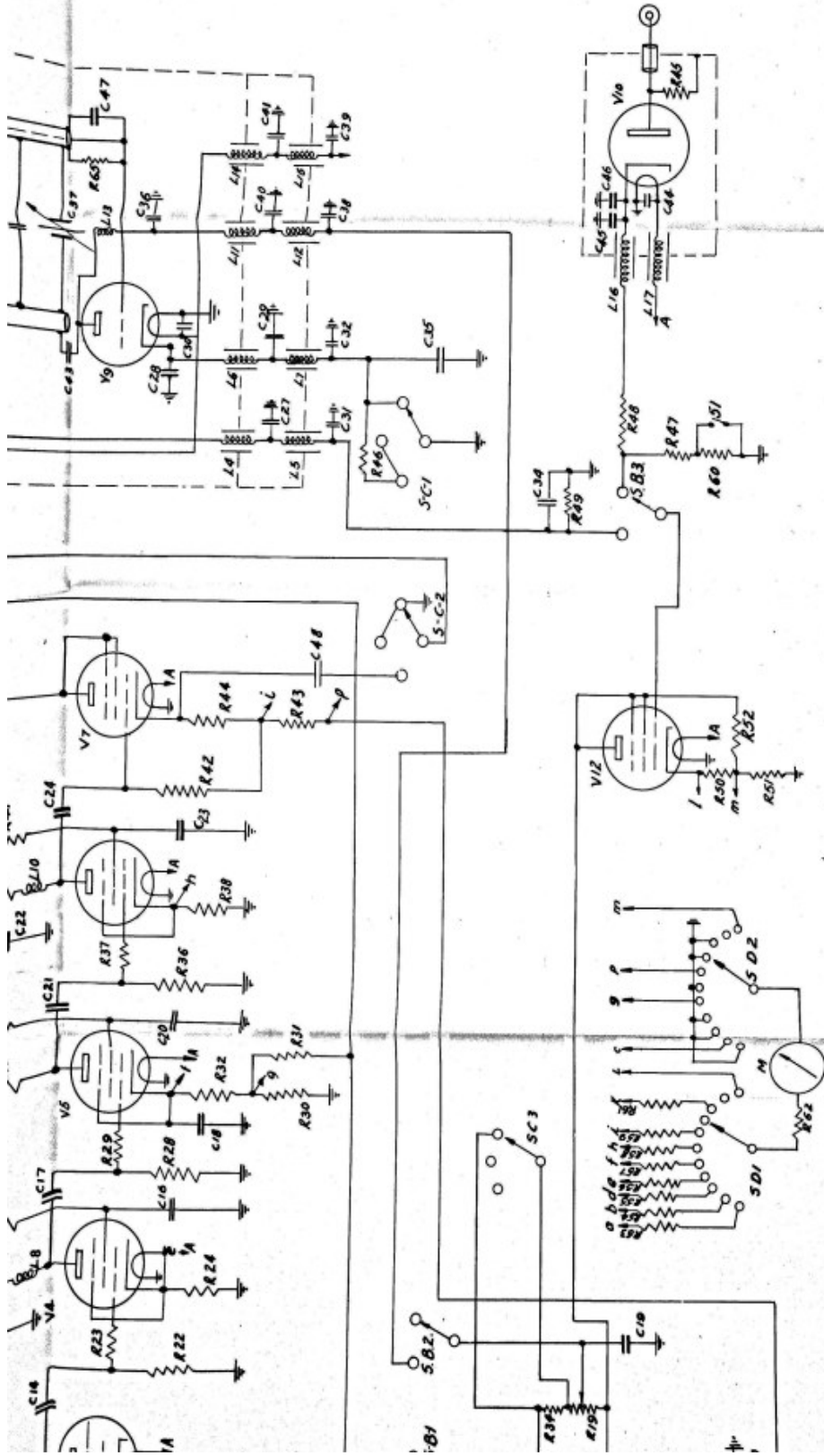
See Dwg. C2517





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| 2              | 1-6-42 |        |  |
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For Chassis details see Dwg  
B2085



R.P.-C.S.I.R.

CIRCUIT DIAGRAM FOR  
1U574

MODIFIED FOR 1U574

For Chassis details see Dwg  
B2085

C 2083

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## RESISTORS

R1 100,000 ohms 1 watt  
R2 500,000 ohms 1 watt  
R3 100,000 ohms 1 watt  
R4 500,000 ohms 1 watt  
R5 20 ohms 1 watt  
R6 50,000 ohms 2 watts  
R7 200,000 ohms 1 watt  
R8 70,000 ohms 1 watt  
R9 500,000 ohms 1 watt  
R10 100,000 ohms 1 watt  
R11 400 ohms 1 watt  
R12 7.5 ohms 1 watt  
R13 25,000 ohms 1 watt  
R14 150,000 ohms 1 watt  
R15 40,000 ohms 3 watts  
R16 400 ohms 1 watt  
R17 30 ohms 1 watt  
R18 10,000 ohms 50 watts  
R19 voltage divider  
25,000 ohms pot.  
spindle insulated  
from moving contact  
R20 200 ohms 3 watts  
R21 15,000 ohms 20 watts  
R22 50,000 ohms 1 watt  
R23 50,000 ohms 1 watt  
R24 20 ohms 1 watt  
R25 20,000 ohms 2 watts  
R26 10,000 ohms 1 watt  
R27 100,000 ohms 1 watt  
R28 100,000 ohms 1 watt  
R29 500,000 ohms 1 watt  
R30 5,000 ohms 1 watt  
R31 100,000 ohms 2 watts  
R32 100 ohms 1 watt  
R33 10,000 ohms 1 watt  
R34 25,000 ohms 3 watts  
R35 100,000 ohms 1 watt  
R36 50,000 ohms 1 watt  
R37 100,000 ohms 1 watt  
R38 20 ohms 1 watt  
R39 20,000 ohms 2 watts  
R40 10,000 ohms 1 watt  
R41 100,000 ohms 1 watt  
R42 500,000 ohms 1 watt  
R43 40 ohms 1 watt

R44 10,000 ohms 1 watt  
R45 75 ohms (2x150 ohms 1 watt)  
R46 20,000 ohms 1 watt  
R47 80,000 ohms 1 watt  
R48 750,000 ohms 1 watt  
R49 5,000,000 ohms 1 watt  
R50 1000 ohms 1 watt  
R51 20,000 ohms 1 watt  
R52 400,000 ohms 2 watts  
R53  
R54  
R55  
R56  
R57  
R58  
R59  
R60  
R61  
R62  
R63  
R64

10,000 ohms 1 watt  
75 ohms (2x150 ohms 1 watt)  
20,000 ohms 1 watt  
80,000 ohms 1 watt  
750,000 ohms 1 watt  
5,000,000 ohms 1 watt  
1000 ohms 1 watt  
20,000 ohms 1 watt  
400,000 ohms 2 watts  
To be chosen to give average meter readings of .5  
300,000 ohms 1 watt  
To adjust meter resistance to 100 ohms.  
75 ohms non inductive.  
15,000 ohms 1 watt

Tolerances. Resistors marked with an asterisk should be accurate to 1%.

Types. Preferred types - Ducon Carbon for 1, 2 and 1 watt. For 2 watt use two 1 watt carbons in parallel where possible.

## CONDENSERS

C1 100,000 ohms 1 watt  
C2 75 ohms (2x150 ohms 1 watt)  
C3 20,000 ohms 1 watt  
C4 80,000 ohms 1 watt  
C5 750,000 ohms 1 watt  
C6 5,000,000 ohms 1 watt  
C7 1000 ohms 1 watt  
C8 20,000 ohms 1 watt  
C9 400,000 ohms 2 watts  
C10 14  $\mu$ f 500 V. Solar elect.  
C11 100  $\mu$ f 450 V. mica  
C12 14  $\mu$ f 500 V. Solar elect.  
C13 14  $\mu$ f 500 V. Solar elect.  
C14 14  $\mu$ f 450 V. mica  
C15 14  $\mu$ f 400 V. wkg. paper  
C16 50  $\mu$ f 500 V. Solar elect.  
C17 50  $\mu$ f 150 V. Solar elect.  
C18 14  $\mu$ f 500 V. Solar elect.  
C19 14  $\mu$ f 500 V. Solar elect.  
C20 14  $\mu$ f 450 V. mica  
C21 14  $\mu$ f 400 V. paper  
C22 14  $\mu$ f 500 V. Solar elect.  
C23 100  $\mu$ f 450 V. mica  
C24 100  $\mu$ f 450 V. mica  
C25 100  $\mu$ f 450 V. mica  
C26 100  $\mu$ f 450 V. mica  
C27 100  $\mu$ f 450 V. mica  
C28 100  $\mu$ f 450 V. mica  
C29 100  $\mu$ f 450 V. mica  
C30 100  $\mu$ f 450 V. mica  
C31 100  $\mu$ f 450 V. mica  
C32 100  $\mu$ f 450 V. mica  
C33 20  $\mu$ f 450 V. mica  
C34 14  $\mu$ f 400 V. wkg. paper  
C35 100  $\mu$ f 40 V. Solar elect.  
C36 100  $\mu$ f 450 V. mica  
C37 Split stator variable  
C38 100  $\mu$ f 450 V. mica  
C39 100  $\mu$ f 450 V. mica  
C40 100  $\mu$ f 450 V. mica  
C41 100  $\mu$ f 450 V. mica  
C42 20  $\mu$ f 450 V. mica  
C43 50  $\mu$ f 450 V. mica  
C44 100  $\mu$ f 450 V. mica  
C45 14  $\mu$ f 400 V. paper  
C46 100  $\mu$ f 450 V. mica  
C47 10  $\mu$ f 450 V. mica  
C48 .05  $\mu$ f 400 V. wkg. paper  
C49 5  $\mu$ f - low temp. coeff.

## TRANSFORMERS

T1 Power transformer 375 V. - 375 V.  
6.3 V. 4 amps.  
5 V. 2 amps.  
T2 A.W.A. magnetite core -  
secondary turns 500 to 550 of 36 S.W.G.  
as necessary

## CHOKES

L1 15 H. 100 ma.  
L2 15 H. 100 ma.  
L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16, L17.  
15 ins. 200 Mc/sec. chokes -  
wire wound on 1/2 W. Ducon ceramic resistor form.  
L8, L10, 4 millihenry compensating coils. RCS Type RP4

## METER

0 - 1 ma.

## SWITCHES

SA-1-2 2 x 2 wafer switch make before break  
SB-1-2-3 2 x 3 wafer switch make before break  
SC-1-2-3 3 x 3 wafer switch  
SD-1-2 11 x 2 wafer switch break before make  
S1 push switch - normally closed.

## VALVES

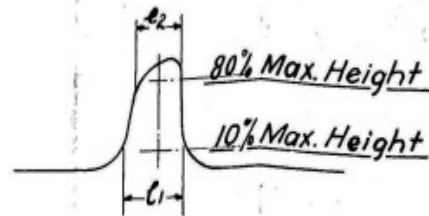
V1 EP50  
V2 EL3NG  
V3 6V5G  
V4 6J7G  
V5 6J7G  
V6 6J7G  
V7 6J7G  
V8 EA50  
V9 955  
V10 EA50  
V11 5V4G  
V12 6J7G

R.P. - O.S.I.R.

1U574

CIRCUIT CODE FOR DRG. C2083.

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$$\frac{l_2}{l_1} \neq \frac{2}{3}$$

FIG. 1a.

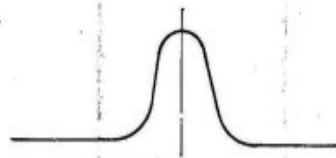


FIG. 1b



FIG. 1c.

|        |         |  |  |                  |         |
|--------|---------|--|--|------------------|---------|
|        |         |  |  | R.P. - C.S.I. R. |         |
|        |         |  |  | P.D. 17/2        |         |
|        |         |  |  | FIG. 1a, 1b 1c.  |         |
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ASD 2023.

AMENDMENT No.1.

The chapter entitled "Bridge Type Switching Motor" is to be added to ASD 2023 immediately following the chapter entitled "Signal Generator." Five pages - Eleven diagrams.

AMENDMENT No.2.

The chapter entitled "AW Test Set" is to be added to ASD 2023 immediately following Amendment No.1. Six pages - Three diagrams.

AMENDMENT No.3.

Drawing CXS53 Fig.1B is to be included in ASD 2023 immediately following the circuit diagram CXS53 Fig.1A in the chapter entitled "Monitoring Cathode Ray Oscillograph."

AMENDMENT No.4.

The present title page for ASD 2023 is to be replaced by the new page corrected for Amendments 1 and 2. The discarded title page is to be destroyed by fire.

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This sheet is to be included in ASD 2023 immediately following Amendment No. 2.